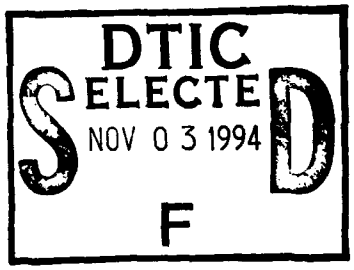


Six Digenetic Trematodes of Mammals from North Borneo (Malaysia)

JACOB H. FISCHTHAL AND ROBERT E. KUNTZ

Reprinted from PROCEEDINGS OF THE HELMINTHOLOGICAL SOCIETY OF WASHINGTON
Vol. 32, No. 2, July 1965, p. 154–159
Made in United States of America

Six Digenetic Trematodes of Mammals from North Borneo (Malaysia)[1]

JACOB H. FISCHTHAL AND ROBERT E. KUNTZ[2]

The trematodes of this report represent a portion of a collection from mammals made by the junior author while a member of the U.S. Naval Medical Research Unit No. 2, Taipei, Taiwan. Schad, Kuntz, Anteson, and Webster (1964) studied the amphistomes. The present specimens were washed in saline, killed in hot water, and transferred immediately to FAA fixative. After 4–8 hr they were stored in 70% alcohol plus 2% glycerine. Staining was in hematoxylin or Mayer's carmalum, and all were mounted in permount. Unless otherwise indicated measurements are in microns.

FAMILY DICROCOELIIDAE

Leipertrema vitellariolateralis Rohde, 1963 (*Fig. 1*)

HOST: *Callosciurus notatus dilutus* (Sciuridae).

HABITAT: Small intestine.

LOCALITIES: Jesselton and Kepayan, North Borneo.

DATES: 31 August (Jesselton), 27 September (Kepayan) 1960.

SPECIMENS: U.S.N.M. Helm. Coll. No. 60969 (two slides with one specimen each).

DISCUSSION: This worm was first described by Rohde (1963a) from the small intestine of *Callosciurus notatus* from Malaya, and again was reported by him (1963b) from the pancreas of *C. caniceps*. The measurements of our four specimens were within the ranges given by Rohde (1963a) and compared favorably with all five of the latter's syntypes (U.S.N.M. Helm. Coll. No. 39469) examined by us. In our specimens the vitellaria on both sides of the body were more laterally and longitudinally distributed. One of Rohde's syntypes showed the right vitelline field more longitudinally distributed than he described. Neither Sandosham (1951) for *Leipertrema rewelli* (type and only other species in the genus) nor Rohde (1936a, b) for the latter and for *L. vitellariolateralis* described or illustrated the details of the terminal genitalia. In our specimens the vasa efferentia join to form a short vas deferens entering the proximal end of the cirrus sac. The latter is somewhat oval, relatively thick walled, and muscular, containing a much coiled, thin walled, tubular seminal vesicle, a short, thin walled, cell lined pars prostatica, a long, thick walled, muscular, winding cirrus opening into a shallow genital atrium, and prostate cells surrounding the pars prostatica and cirrus. The metraterm is thick walled, muscular, slightly winding, surrounded by gland cells throughout its length, slightly longer than the cirrus sac, and opens into the genital atrium.

Lutztrema callosciuri n. sp. (Figs. 2, 3)

HOST: *Callosciurus prevostii pluto* (Sciuridae).

HABITAT: Liver.

LOCALITY: Ranau, North Borneo.

DATE: 22 September 1960.

TYPES: U.S.N.M. Helm. Coll. No. 60970 (one slide of holotype and one of paratype).

DIAGNOSIS (based on four specimens, two measured): Body narrow, elongate, length 1,901 to 2,685, forebody width 106 to 133, width at vitellaria 305 to 350. Forebody 395 to 465, hind body 1,740 to 2,066; postovarian space 1,250 to 1,400, postvitellarian space 850 to 974. Preoral body 10 to 12 long, tapered to blunt point, humplike. Oral sucker (in three) 73 to 133 by 65 to 116, subterminal ventral. Acetabulum (in three) 81 to 155 by 118 to 179, nearly as wide as body, slightly elevated from body surface. Sucker length ratio (in three) 1 : 1.11 to 1.17. Pharynx 47 to 52 by 61 to 67, overlapping oral sucker dorsally.

[1] Contribution from the Department of Biology, Harpur College, State University of New York, Binghamton (J. H. Fischthal).

[2] Address of R. E. Kuntz: Southwest Foundation for Research and Education, San Antonio, Texas.

This study, Research Task MR. 005.09.-1031.02, Bureau of Medicine and Surgery, Navy Department, was supported in part by funding under Public Law 480, Section 104(c). The opinions and assertions herein are those of the authors and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

The authors are indebted to Dr. David H. Johnson, Curator of Mammals, U.S. National Museum, for host identifications, and to Woodrow Bristline, HMC, USN, Bob Ray Davis, HM1, USN, Jack Hegg, HM1, USN, Dr. Changsheng Tseng, Mr. Ching-tsong Lo, and Mr. Atvar Gill for assistance in the collection and examination of hosts. Mr. Henry Holland, Director, Kepayan Veterinary Station, Jesselton, provided facilities for the NAMRU field party, and Mr. G. L. Carson, Conservator of Forests, Sandakan, provided permits for the collection of mammals.

Cecum single, descending right of midline to posterior testis level before being masked by eggs, dorsal to acetabulum, testes and uterus. Excretory bladder not visible; pore terminal.

Testes two, diagonal, large relative to body width, smooth, elongate oval; anterior (left) testis 155 to 186 by 123 to 167, 29 to 58 postacetabular; posterior (right) testis 182 to 211 by 140 to 179, 177 to 260 postacetabular, overlapping level of anterior testis in one and 29 posterior in one, 5 to 70 preovarian. Cirrus sac 117 to 140 by 43 to 65, thick walled, muscular, commencing 29 to 61 preacetabular, containing seminal vesicle, pars prostatica, prostate cells and cirrus. Seminal vesicle tubular, much coiled, thin walled; pars prostatica short, thin walled, surrounded by prostate cells; cirrus long, straight, thick walled, muscular, surrounded by prostate cells, opening into genital atrium. Genital pore median to slightly submedian, 142 to 196 preacetabular, 87 to 103 postpharyngeal, 121 to 130 posterior to oral sucker.

Ovary 128 to 133 by 140 to 158, wider than long, smooth, sinistral, diagonal to posterior testis and in line with anterior testis, 353 to 555 postacetabular. *Seminal receptacle* (in one) 48 by 57, dorsal, overlapping posterodorsal edge of ovary. Laurer's canal muscular, sinuous, posterosinistral to ovary, sinistral to seminal receptacle. Vitellaria more or less in band across body, longitudinal extent 320 to 325, entire left field slightly more anteriorly placed than right, 515 to 735 postacetabular, 32 to 53 postovarian. Uterus voluminous, filling entire postovarian body; ascending right of ovary, crossing body between testes, right of anterior testis, crossing body between latter and acetabulum, over left portion of latter in slightly sinuous path to genital pore. Metraterm slightly thick walled, muscular, slightly shorter than cirrus sac. Eggs numerous, thick shelled, operculate, 18 measuring 29 to 36 by 18 to 23.

DISCUSSION: This is the first record of the genus from mammals; all other species are from birds. Skrjabin and Evranova (1953) placed seven species in the genus and Yamaguti (1958) 15; two additional species not listed in either volume have been described: *L. skrjabini* Rysavy, 1955; *L. heterocoraxi* Bisseru, 1960. Localities from which species of *Lutztrema* Travassos, 1941, have previously been reported are South, Central and North America, Europe, South Africa, India, and Japan. Our specimens appear closest to *L. colorosum* (Patwardhan, 1935) Travassos, 1944 (syn. *Lyperosomum bhattacharyai* Pande, 1939) from Indian birds but differ in having a mammalian host and suckers which are subequal in length rather than with a ratio of about 1 : 2.

Platynosomum fastosum Kossack, 1910

HOST: *Felis catus domesticus* (Felidae).

HABITATS: Liver and small intestine.

LOCALITIES: Jesselton, Tuaran, Kepayan; North Borneo.

DATES: 31 August, 16, 29 September 1960.

SPECIMENS: U.S.N.M. Helm Coll. No. 60971 (five slides with one specimen each).

MEASUREMENTS and some pertinent data (based on 20 specimens, nine measured): Body, length 4,031 to 6,201, forebody width at genital pore level 630 to 897, hind body maximum width 1,028 to 1,970, widest at testicular level in five and at vitellaria in four; forebody 798 to 1,335, hind body 2,876 to 4,563; preoral body 6 to 40, postovarian space 2,364 to 3,528, postvitellarian space 1,572 to 2,677, postcecal space 395 to 752; oral sucker 335 to 445 by 300 to 450; acetabulum 357 to 480 by 340 to 475, entirely muscular in 11 specimens, partly parenchymatous to varying extents in five; sucker length ratio 1 : 1.05 to 1.18; pharynx 116 to 140 by 116 to 150; esophagus 75 to 305 in longitudinal extent, bifurcating 260 to 480 preacetabular; right testis 455 to 690 by 315 to 480; left testis 460 to 675 by 310 to 522; cirrus sac 300 to 415 by 116 to 159, overlapping acetabulum 9 in one and 63 to 185 preacetabular in eight, entirely preacetabular in eight other specimens, containing a much coiled, tubular, thick-walled, cellular seminal vesicle, a short pars prostatica, a long, sometimes sinuous, thick-walled, muscular, protrusible cirrus, and prostate cells surrounding the latter and pars prostatica; genital pore prebifurcal, median, 295 to 587 preacetabular, 50 to 167 postpharyngeal, 135 to 280 posterior to oral sucker; ovary 247 to 450 by 220 to 380, submedian to right in eight, to left in eight; seminal receptacle 101 to 157 by 101 to 157, from longer than wide to round to wider than long, dorsal to posteromedian part of ovary; vitelline fields 813 to 1,640 long; metraterm thick walled, muscular, straight, about same length as or slightly shorter than cirrus sac; 45

operculate eggs measuring 29 to 44 by 19 to 27.

DISCUSSION: Four and 12 worms, respectively, were taken from the liver of two domestic cats and four from the small intestine of a third. Rohde (1962) reported this species from the same habitats and host species from Malaya (Malaysia). Additional hosts reported by various authors are *Oncoides minuta*, *Grison vittata*, and *Herpailurus y. yaguarondi*; additional localities are Hawaii, Brazil, Cuba, Puerto Rico, Bahamas, North America, and Africa.

Zonorchis borneoensis n. sp. (Figs. 4, 5)

HOSTS: Type, *Callosciurus prevostii pluto*; *C. notatus dilutus* (Sciuridae).

HABITATS: Liver and small intestine.

LOCALITIES: Ranau (*C. prevostii*) and Kasiqui (*C. notatus*), North Borneo.

DATES: 30 August (Kasiqui), 20, 24 September (Ranau), 1960.

TYPES: U.S.N.M. Helm. Coll. No. 60972 (one slide of holotype and four with one paratype each).

DIAGNOSIS (based on 17 specimens, nine measured): Body elongate, tapering to blunt point at both extremities, widest at gonadal or just postgonadal level, length 1,891 to 5,758, forebody width at pharynx–esophagus junction 175 to 458, hind body width 365 to 1,495. Forebody 305 to 860, hind body 1,435 to 4,398; no preoral body in two, up to 34 long in others; postovarian space 1,070 to 3,288, postvitellarian space 310 to 1,438, postcecal space 225 to 1,115. Oral sucker 109 to 290 by 109 to 285, subterminal ventral. Acetabulum 151 to 500 by 170 to 510, elevated from body surface. Sucker length ratio 1 : 1.39 to 1.86. Pharynx 56 to 180 by 61 to 165, overlapping oral sucker dorsally. Esophagus 73 to 215 long, bifurcating 5 to 250 preacetabular. Ceca long, narrow, extending postvitellarian, terminating well short of posterior extremity, usually of unequal lengths. Excretory bladder tabular to I- to Y-shaped; stem long, slender, dorsal to uterus, commencing or bifurcating 200 to 430 postovarian (in three specimens 3,591 to 5,758 long); only one or both primary collecting tubules at junction with bladder may be inflated into short excretory arms of varying lengths; primary tubules extending to pharyngeal level; excretory pore terminal.

Testes two, symmetrical, short distance postacetabular, close together, intercecal but may slightly overlap cecum dorsally, usually elongate–oval, usually smooth; right testis 109 to 820 by 73 to 440; left testis 109 to 540 by 80 to 425. Vasa efferentia from anterodorsal surface of testes entering cirrus sac side by side. Cirrus sac 167 to 562 by 51 to 170, thick-walled, muscular, elongate, straight, more or less median, overlapping anterior part of acetabulum 17 to 182, containing seminal vesicle, pars prostatica, prostate cells, and cirrus. Seminal vesicle tubular, much coiled, thick-walled, cellular; pars prostatica short; cirrus long, sinuous thick-walled, muscular, opening into small genital atrium; prostate cells relatively few, beside distal part of seminal vesicle, the pars prostatica and cirrus; cirrus sac protrusible. Genital pore median to slightly submedian, 120 to 363 preacetabular, 15 to 44 postpharyngeal, 44 to 175 posterior to oral sucker.

Ovary 68 to 285 by 73 to 305, essentially round, smooth; submedian to left in nine, to right in five; slightly overlapping testicular level to 94 posttesticular. Seminal receptacle 38 to 143 by 40 to 155, posterior to ovary, contiguous with or slightly overlapping latter dorsally. Laurer's canal muscular, sinuous, median to seminal receptacle. Mehlis' gland well developed, posteromedian to ovary. Oviduct thick-walled, from posterior of ovary. Vitellaria follicular, in long extracecal fields but may

→

Fig. 1. *Leipertrema citellariolateralis*, terminal genitalia, dorsal view.

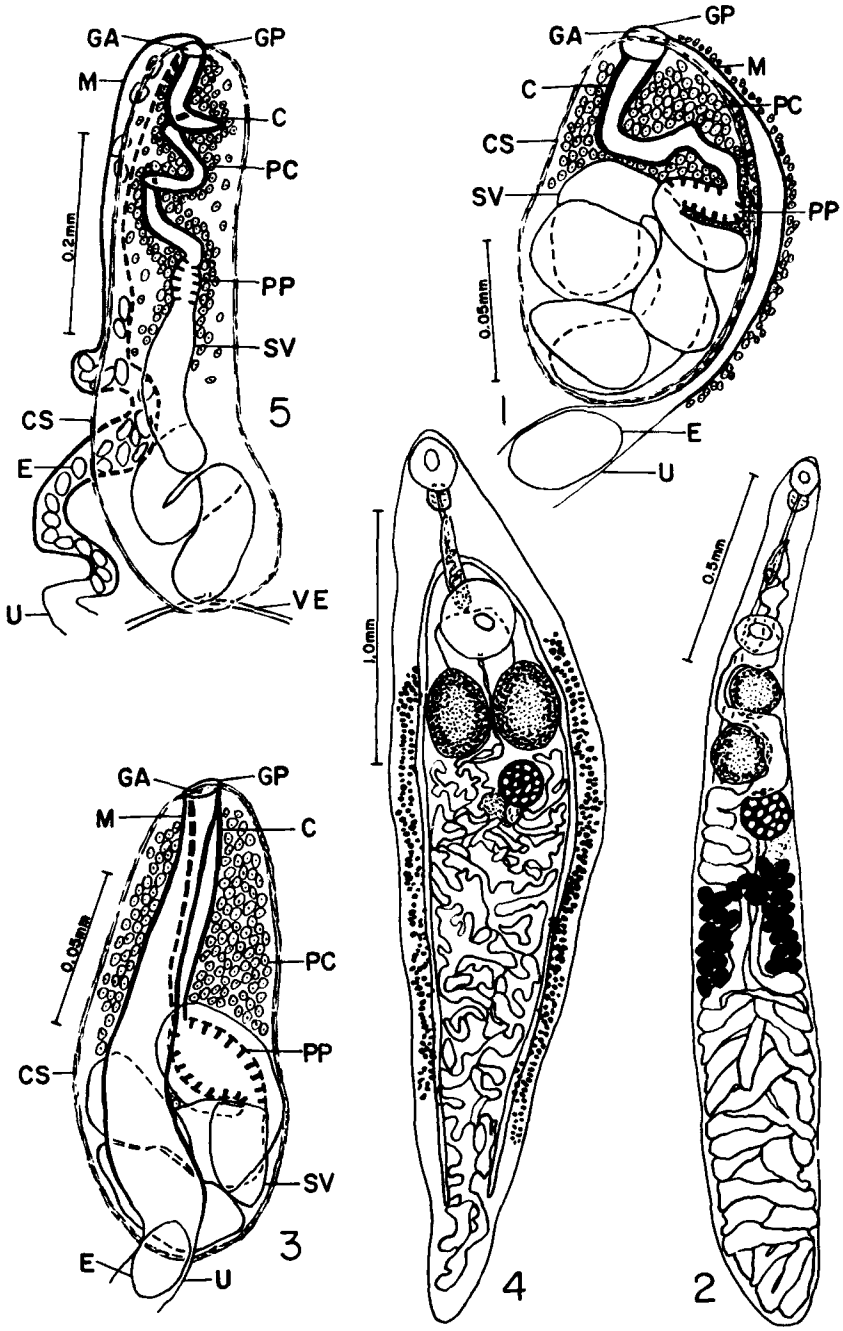
Fig. 2. *Lutztrema callosciuri*, holotype, ventral view.

Fig. 3. Same. Terminal genitalia, paratype, dorsal view.

Fig. 4. *Zonorchis borneoensis*, holotype, ventral view.

Fig. 5. Same. Terminal genitalia, paratype, ventral view.

Abbreviations: C, cirrus; CS, cirrus sac; E, egg; GA, genital atrium; GP, genital pore; M, metraterm; PC, prostate cells; PP, pars prostatica; SV, seminal vesicle; U, uterus; VE, vas efferens.


GA
GP
M
C
PC
PP
SV
CS
E
U
VE
0.2mm
0.05mm
1.0mm
0.5mm
1
2
3
4
5

overlap ceca slightly and rarely protrude into intercecal space, commencing at level of posterior half of acetabulum, terminating well short of cecal at different levels; right and left vitelline ducts postovarian, uniting median to seminal receptacle and ventral to Mehlis' gland to form small reservoir. Uterus extensive, filling most of posttesticular body, mainly intercecal but may overlap ceca; descending on left and ascending on right if ovary on left, reverse condition if ovary on right, coils ascending on median side of ovary and between testes to genital pore; metraterm thick-walled, muscular, sinuous, as long as cirrus sac or shorter. Eggs numerous, operculate, 30 measuring 25 to 32 by 16 to 22.

DISCUSSION: Six specimens were taken from the liver of one *Callosciurus prevostii pluto* and two and eight, respectively, from the small intestine of two others; one worm was from the liver of one *C. notatus dilutus*. Skrjabin and Evranova (1953) recognized seven species from birds and four from mammals, while Yamaguti (1958) listed ten and four, respectively; eight additional species not listed in either volume have been described: From birds, *Z. travassosi* Jaiswal, 1957; *Z. singhi* Jaiswal, 1957; *Z. costarricensis* Brenes and Jiménez-Quirós, 1959; *Z. macroovaricus* Jiménez-Quirós and Arroyo, 1960; *Z. dureni* Vercammen-Grandjean, 1960; *Z. dollfusi* Richard, 1962; *Z. hartwichi* Odening, 1964; from mammals, *Z. australiensis* Sandars, 1958. The latter (from Australia) and three other mammalian species (from Brazil, Panama, Trinidad) are from marsupials. *Z. komarcki* (McIntosh, 1939) Travassos, 1944, has been taken from two species of cricetid rodents, *Peromyscus g. gossypinus* and *Oryzomys palustris*, in the United States. Our new species from sciurid rodents differs from *Z. komarcki* in geographical distribution and in having much shorter ceca, the testes entirely postacetabular and close together, and the cirrus sac overlapping the acetabulum.

FAMILY HETEROPHYIDAE

Haplorchis pumilio (Looss, 1896) Looss, 1899

HOST: *Prionailurus bengalensis borneoensis* (Felidae).
HABITAT: Small intestine.
LOCALITY: Ranau, North Borneo.
DATE: 18 September 1960.
SPECIMENS: U.S.N.M. Helm. Coll. No. 60973 (five slides with one specimen each).

MEASUREMENTS and some pertinent data (based on 21 specimens from one host, six measured): Body 430 to 513 by 145 to 167; oral sucker 43 to 51 by 53 to 58, wider than long; acetabulum 34 to 54 by 46 to 64, usually wider than long, bearing almost complete circlet of 33 to 38 spines and additional group of simple spines in interrupted area; prepharynx 21 to 29 long; pharynx 27 to 34 by 25 to 32; esophagus 70 to 123 long; testis 63 to 77 by 57 to 74; ovary 43 to 47 by 41 to 53; seminal receptacle 46 to 54 by 44 to 52; 30 eggs measuring 25 to 31 by 14 to 19.

DISCUSSION: Pearson (1964) reviewed and redescribed *H. pumilio*. We (1965) reported this species from two species of reptiles from North Borneo. Comparison of the present specimens from the leopard cat with the latter and with three of Dr. Pearson's worms from the water rat, *Hydromys chrysogaster*, from Brisbane, Australia, showed them to be identical.

FAMILY PARAGONIMIDAE

Paragonimus westermani (Kerbert, 1878) Braun, 1899

HOST: *Prionailurus bengalensis borneoensis* (Felidae).
HABITAT: Lungs.
LOCALITY: Ranau, North Borneo.
DATE: 27 September 1960.
SPECIMENS: U.S.N.M. Helm. Coll. No. 60974 (five slides with one specimen each).

DISCUSSION: Our collection consisted of 13 worms measuring 7 to 8.8 mm in length from a single leopard cat. Yokogawa, Cort, and Yokogawa (1960) noted that specific identification of members of the genus *Paragonimus* Braun, 1899, is most difficult. They also noted that *P. westermani* was originally described from Indian tigers that died in zoological gardens in Holland and Germany. The most recent Malaysian report of this trematode is by Rohde (1963b) from a tiger from Malaya. *P. westermani* has been reported from a wide variety of hosts (mainly the cat family) distributed from Japan, Korea, and Manchuria on the north to the Philippines, Indonesia, and India on the south.

LITERATURE CITED

FISCHTHAL, J. H., AND R. E. KUNTZ. 1965. Digenetic trematodes of amphibians and reptiles

from North Borneo (Malaysia). Proc. Helm. Soc. Wash. 32: 63–71.

PEARSON, J. C. 1964. A revision of the subfamily Haplorchinae Looss, 1899 (Trematoda: Heterophyidae). I. The *Haplorchis* group. Parasitology 54: 601–676.

ROHDE, K. 1962. Helminthen aus Katzen und Hunden in Malaya; Bemerkungen zu ihrer epidemiologischen Bedeuting für den Menschen. Ztschr. Parasitenk. 22: 237–244.

———. 1963a. *Leipertrema vitellariolateralis* n. sp. from the intestine of *Callosciurus notatus* in Malaya. J. Helm. 37: 131–134.

———. 1963b. Über einige malayische Trematoden. Ztschr. Parasitenk. 22: 268–277.

SANDOSHAM, A. A. 1951. On two helminths from the orang utan, *Leipertrema rewelli* n. g., n. sp. and *Dirofilaria immitis* (Leidy, 1856). J. Helm. 25: 19–26.

SCHAD, G. A., R. E. KUNTZ, R. K. ANTESON, AND G. F. WEBSTER. 1964. Amphistomes (Trematoda) from domestic ruminants in North Borneo (Malaysia). Can. J. Zool. 42: 1,037–1,040.

SKRJABIN, K. I., AND V. G. EVRANOVA. 1953. *Family Dicrocoeliidae* Odhner, 1911. *In* Skrjabin, K. I. [Trematodes of animals and man]. Moskva 7: 33–604. 1952.

YAMAGUTI, S. 1958. Systema helminthum. Vol. I. Digenetic trematodes of vertebrates. Parts I and II. 1,575 p. Interscience Publ., N.Y.

YOKOGAWA, S., W. W. COBB, AND M. YOKOGAWA. 1960. *Paragonimus* and paragonimiasis. Exp. Parasit. 10: 81–137, 139–205.